PRELIMINARY SURVEY: IBOOKS FOR ENGINEERING SUBJECTS IN UTEM

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ABSTRACT

In this Industrial Revolution 4.0, the digital technology has played its important role in shaping the the education. Digital technology for teaching and learning materials improves progressively, and the implementation is now taking place especially for engineering subjects in the universities in Malaysia. In this paper, we discuss the perception of students on the digital interactive books— iBooks (for the Apple iPad and iPhone)—we created for undergraduate engineering students in Universiti Teknikal Malaysia Melaka (UTeM). The findings demonstrate that students can learn the engineering subject better with the iBooks and they want to spend more time with iBooks to learn independently. The latter finding is important for the implementation of flipped learning pedagogy in the university.

1. INTRODUCTION

Today's students are completely engaged with technologies. They interact with the world through smartphones, computers and tablets. If in the previous decades the teacher is the source of knowledge, now the sources of information and knowledge are available at the finger tips. As such, the learning styles and the needs of the student in this 21st century must be accommodated.

Keane et al. [2] reported that the use of iPad and Netbook influenced and enthused teachers and students, allowing more student-centred pedagogies to be developed, improving communication and literacy of students. However, dedicated teachers are important and they must be prepared to shift into the technological-based pedagogy.

The conventional didactic lectures especially in the university (where the students are adult learners) is now questionable in terms of its effectivity to transfer knowledge, and thus various pedagogies are gaining popularity, for example problem-based learning and flipped learning [1, 2]. In particular for the latter, use of digital technology is crucial to ensure the self-learning (at home) happens and to keep the students engage with the subject. Interactive content is therefore necessary.

One of the digital technologies which provides interactive media is iBooks from Apple. iBooks is an interactive book which can accommodate not just pictures, but also videos, HTML animations and 3D images integrated in 'one book'. Students can highlight the texts, create notes, and can directly share the thoughts with peers. iBooks also has accessibility features which allows the book to also be accessed by the blind impaired student. The iBooks can be just a substitution of a normal pdf e-Book if it is not properly designed, especially if the interactivity elements are not fully utilised. iBooks must designed to redefine the student's learning.

A study conducted on the student's performance in Biology subject indicates that: (i) students using iBooks had significantly higher post test scores when compared to their peers using printed books, (ii) students using iBooks showed gains in achievement over the course of the year, while those using printed books shows significant decrease in achievement, and (iii) students using printed

books experienced a decrease in motivation score, while the score of students using iBooks remained the same [3]. There is still a lack of research about the impact of iBooks on learning, particularly for engineering subjects. This paper is aimed at contributing to the preliminary study on the impact of iBooks for undergraduate students in our university.
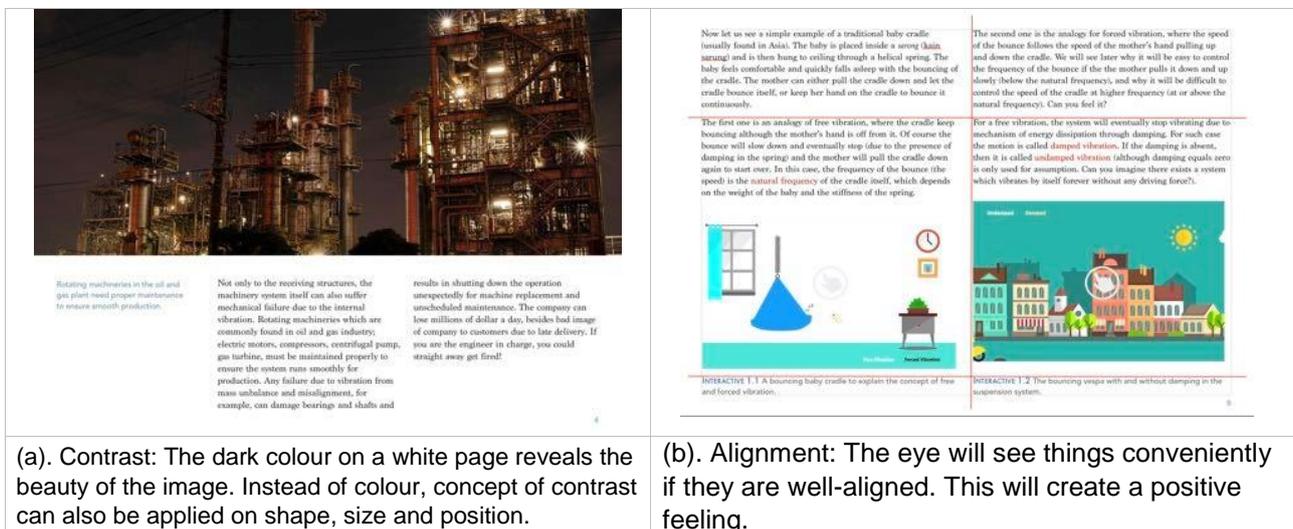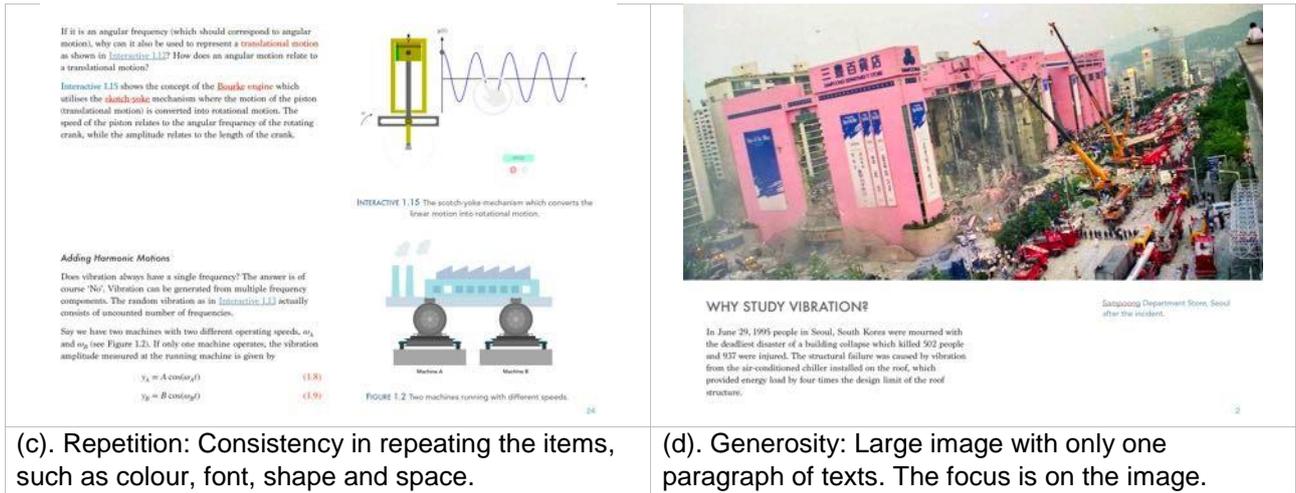
2. METHODOLOGY

2.1 Development of iBooks

We created two iBooks for undergraduate engineering subjects, namely Mechanical Vibration (3rd year students) and Multimedia Signal Processing (4th year students). We consider two main factors in developing the iBooks, i.e. design and interactivity.

Design
The aspect of design is rarely taken into consideration by lecturers and teachers when developing the teaching slides or lecture notes; documents used as the main learning materials by students. Design here is not only about the content, but merely on the visual appearance of the document which affects the visual communication with the reader. As pointed out by Norman [4], "*Attractive things make people feel good, which in turn makes them think more creatively...positive emotions are critical to learning, curiosity, and creative thought*"

We adopted some basic principles in our iBooks, namely contrast, alignment, proximity and generosity [5]. The default templates in iBooks Author actually apply these principles implicitly. Figure 1 summarises the application these design elements in our iBooks.

(a). Contrast: The dark colour on a white page reveals the beauty of the image. Instead of colour, concept of contrast can also be applied on shape, size and position.	(b). Alignment: The eye will see things conveniently if they are well-aligned. This will create a positive feeling.

(c). Repetition: Consistency in repeating the items, such as colour, font, shape and space.	(d). Generosity: Large image with only one paragraph of texts. The focus is on the image.

Figure 1: Examples of pages our the iBooks applying the principles of design.

Interactivity

In engineering subjects, many physical phenomena involved. Interactive elements to visualise the phenomena are thus required for student to better grasp an engineering concept. Thanks to iBooks where the element of interactivity can be integrated such as videos, keynote and HTML files.

In Mechanical Vibration subject where dynamic movement is involved, interactive elements are thus important. Figure 2(a) shows the example of interactivity in iBooks of a Bourke's engine to explain the skotch-yoke mechanism which visualises the process of converting the translational motion to rotational motion. The speed of the piston can also be changed by tapping a button. Figure 2(b) shows example of digital sampling in image processing. The image of Monalisa for correctly sampled or undersampled is shown by swiping the image right and left.

(a). Skotch-yoke mechanism in Bourke's engine (tap and play).	(b). Digital sampling on Monalisa painting (swipe)
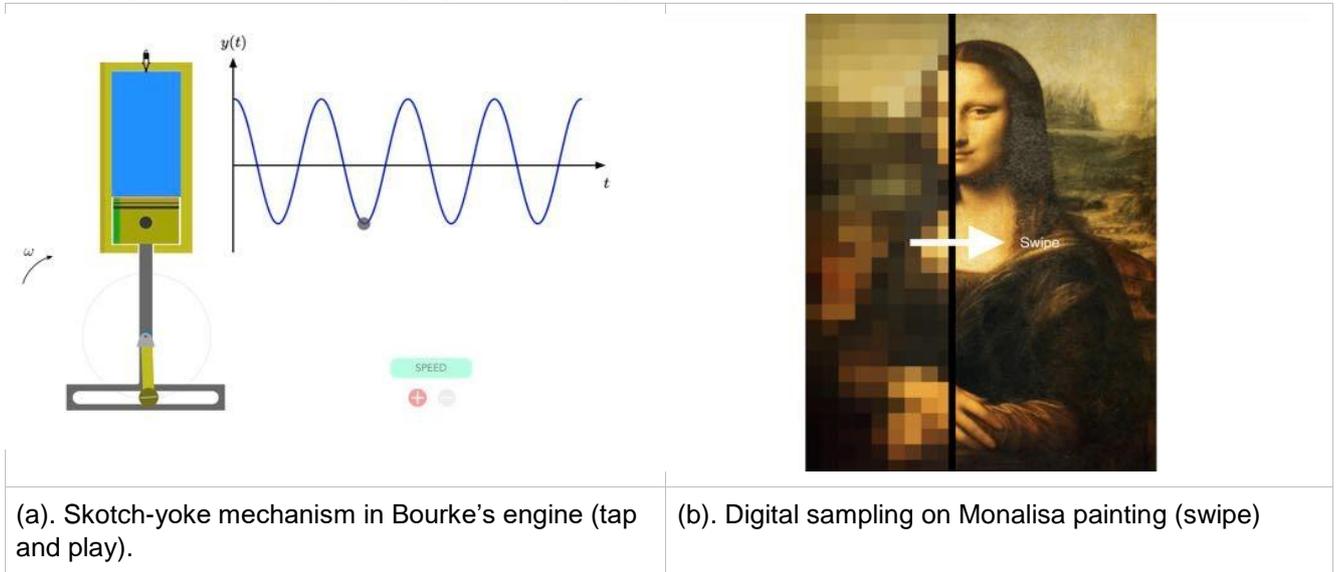
Figure 2. Examples of interactivity in our iBooks.
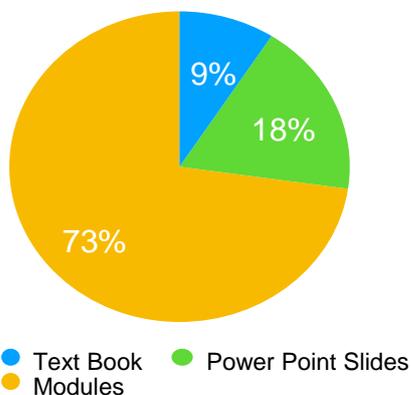
2.2 Survey

The survey was taken after the semester was offer. This involves 15 third year students taking subject Mechanical Vibrations (BMCM3743) in Faculty of Mechanical Engineering and 48 fourth year students taking Multimedia Signal Processing (BMCT8393) in Faculty of Electrical and Computer Engineering. For the former, the students used iPhones to read the iBooks, while for the latter, the students used iPad in the classroom. The following are the questions in the survey:

a. What is the common learning materials for you to learn at home?
b. With Text Book, Power Point Slides or Modules, do you think that you can learn yourself easily?
c. According to you, what is the main problem with the current learning materials?
d. For Flipped Learning, what is the tendency that you will study at home before coming to the class?
e. Do you find my iBooks interactive and engaging? How would you rate?
f. What is the most engaging feature of my iBooks?
g. Did my iBooks change your feeling about Engineering subject?
h. Do you feel that using iBooks you can learn Engineering subject better?
i. Do you feel that you want to spend more time studying at home with the iBooks?

## 3. RESULTS AND DISCUSSION

Figure 3 shows the response from the survey about the conventional teaching materials, namely text book, power point slides or modules. These materials are not necessarily printed. Some materials are available to students in soft copy form (pdf files, ppt files). Most of the students from the two classes study outside the class using the teaching module. The teaching module consists of example questions and solutions, which indicates that students most likely prefer to do the exercises on solving problems at home to understand the theory taught in the class.

What is the learning materials for you to learn outside the class?

With Text Book, Power Point Slides or Modules, do you think that you can learn yourself easily?

Text Book   Power Point Slides
Modules

Yes   No   Not Sure

According to you, what is the main problem with the learning material you have now?
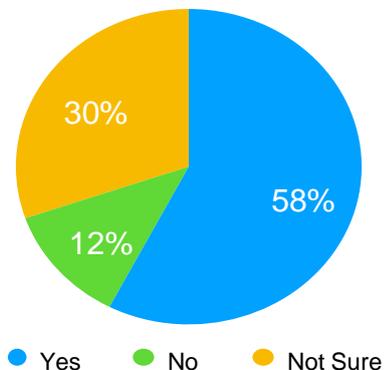
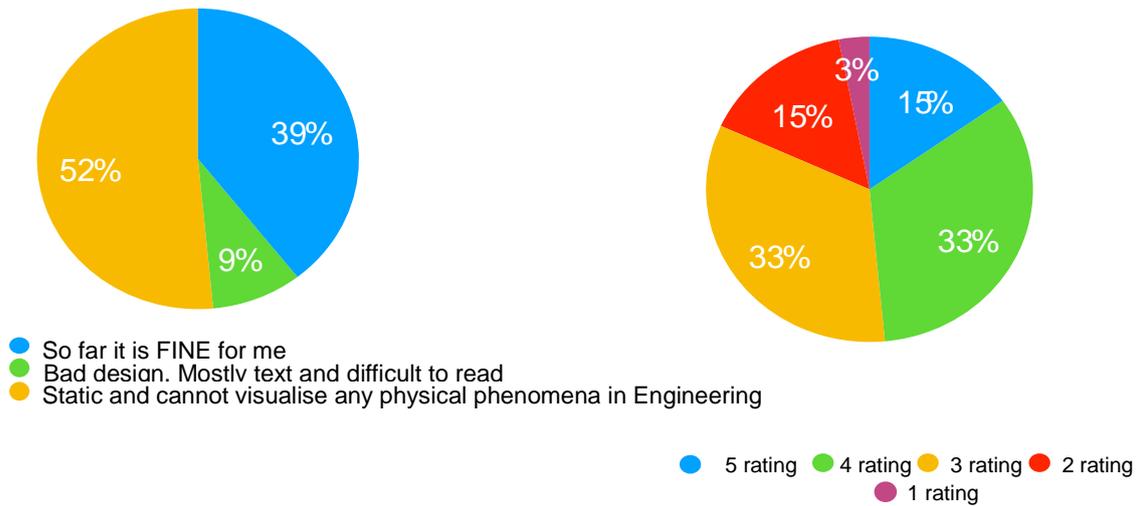For Flipped Learning, what is the tendency that you will study at home before coming to the class?

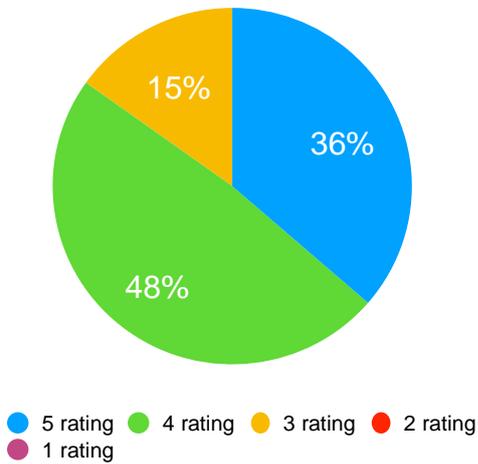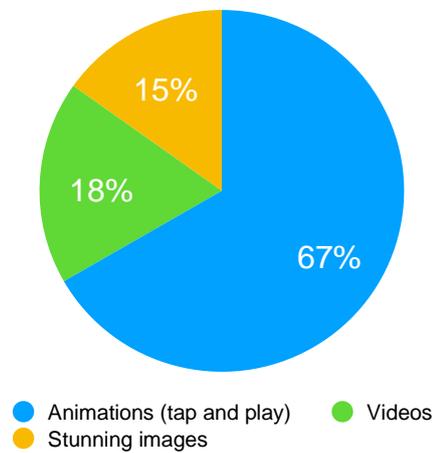**Figure 3. Response relating to common learning materials other than iBooks**

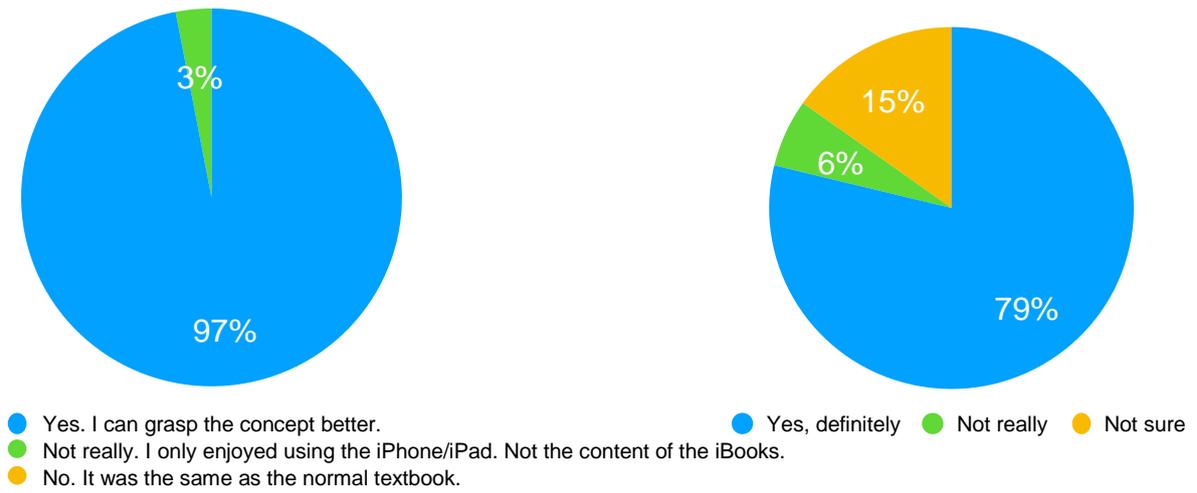Do you find my iBooks interactive
and engaging? How would you rate?

What is the most engaging
feature of my iBooks?

Did my iBooks change your
feeling about Engineering subject?

Do you feel that using
iBooks you can learn
Engineering subject better?

Yes. I can grasp the concept better.
Not really. I only enjoyed using the iPhone/iPad. Not the content of the iBooks.
No. It was the same as the normal textbook.

Yes, definitely   Not really   Not sure

Do you feel that you spent more time studying outside the class with the iBooks?

5 rating   4 rating   3 rating   2 rating
1 rating
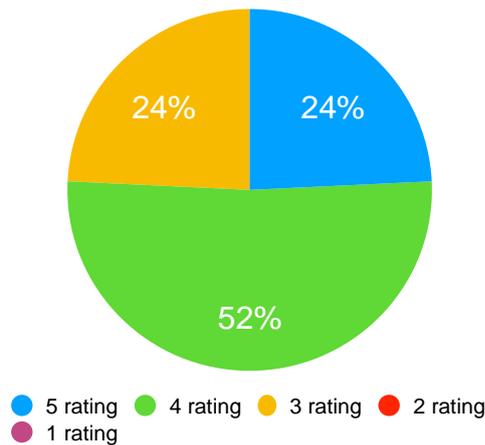
Figure 4. Response relating to iBooks

Almost half of the respondents say they are not sure or cannot learn by themselves outside the class using these materials. The most reason is that the material is a static material which cannot visualise any physical phenomena in Engineering. This could lead to deficiency of student's motivation in self-study [4].

The indication is further strengthen in the last chart where more than half of the students shows low tendency (ratings 1-3 out of 5) that they will conduct self-learning using the conventional materials. The self-learning (learning the material at home) is one of the key successes of flipped classroom or flipped learning.

The response concerning the iBooks are shown in Figure 4. Almost all students (84%) find that the iBooks are engaging, where the animation feature (with tap and play) is the most engaging part. Animated graphics can improve the cognitive aspect of learning and thus it has to be properly designed [6,7]. Students learned better of complex computer algorithm using animation [8]. The same

was also found in teaching, where animated learning materials were more useful to undergraduate computer games students than traditional learning materials for learning mathematical concepts [9].

All students also find that they can grasp the engineering concept better with iBooks. And most importantly, 74% of students think they spent more time with the iBooks. Because the process of remembering and understanding (the lowest part of bloom taxonomy) has been catered outside the class, the higher part of the bloom (applying, analysing, evaluating and creating) can be focused in the class (flipped learning) [10]. It was suggested that the format and structure of learning materials in the flipped classroom contributed significantly to the student's satisfaction with their flipped learning experiences [11]. For this purpose, the iBooks can be a suitable choice among any interactive media.

4. CONCLUSION

Survey on the perception of iBooks has been done. The main findings reveal that students can learn better with iBooks to grasp the concepts in engineering and they want to spend more time to study outside the class, which is important for the implementation of flipped learning. Again, the impact of iBooks depend on how the author design the content, i.e. by optimising its interactive features. Otherwise the iBooks is just a substitution of digital e-Book. The long term study of its impact on student's learning can be further conducted by analysing the student academic performance with and without the iBooks.

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